Light Transport Techniques for Tensor Field Visualization

Master's Thesis Presentation

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Transmission Profiles

To interpret singular value systems of tensors as conductivity property for light transport, we will need transfer functions (transmission profiles) for the propagation scheme:

Ellipse Equation

$$T(\omega) = \frac{ab}{\sqrt{a^2 \sin^2(\omega - \varphi) + b^2 \cos^2(\omega - \varphi)}} = \frac{\sigma_1 \sigma_2}{\sqrt{\sigma_1^2 \sin^2(\omega - \varphi) + \sigma_2^2 \cos^2(\omega - \varphi)}}$$

with $\varphi = atan2(\sigma_{1,y}, \sigma_{1,x})$ and σ: singular value, a: x-radius ellipse, b: y-radius ellipse

$\Rightarrow$ transmission profiles $r(\omega)$ are defined as polar functions by the mapping of singular values to half-axes radii and the shift angle of the major singular vector φ

Related Work - Asymmetric Tensor Field Visualization

- dual eigenvectors[1]: use complex conjugate eigenvectors as co-visualization for the complex domain along with ordinary eigenvectors to represent the real domain
- pseudo eigenvectors[2]: extension for dual eigenvectors to a full set or graph
- scalar measures: tensor magnitude[3], tensor mode[4], isotropy index[5]

[1] Zheng and Pang "2d asymmetric tensor analysis", 2005
[2] Laramee et al. "2d asymmetric tensor field topology", 2012
[3] Lin et al. "Asymmetric tensor field visualization for surfaces", 2011
[4] Palacios et al. "Feature surfaces in symmetric tensor fields based on eigenvalue manifold", 2015
[5] see footnote 12